4. On comparing the action of such compounds as C_9H_7N (chinoline) with $C_9H_{13}N$ (parvoline &c.), or $C_8H_{11}N$ (collidine) with $C_8H_{15}N$ (conia, from hemlock), or $C_{10}H_{10}N_2$ (dipyridine) with $C_{10}H_{14}N_2$ (nicotine, from tobacco), it is to be observed that the physiological activity of the substance is, apart from chemical structure, greatest in those bases containing the larger amount of hydrogen.

5. Those artificial bases which approximate the percentage composition of natural bases are much weaker physiologically, so far as can be estimated by amount of dose, than the natural bases; but the *kind* of action is the same in both cases.

6. When the bases of the pyridine series are doubled by condensation, producing dipyridine, parapicoline, &c., they not only become more active physiologically, but the action differs in kind from that of the simple bases, and resembles the action of natural bases or alkaloids having a similar chemical constitution.

7. All the substances examined in this research are remarkable for not possessing any specific paralytic action on the heart likely to cause syncope; but they destroy life either by exhaustive convulsions, or by gradual paralysis of the centres of respiration, thus causing asphyxia.

8. There is no appreciable immediate action on the sympathetic system of nerves. There is probably a secondary action, because after large doses the vasomotor centre, in common with other centres, becomes involved.

9. There is no difference, so far as could be discovered, between the physiological action of bases obtained from cinchonine and those derived from tar.

XVI. "On the Calculus of Factorials." By the Rev. H. F. C. Logan, LL.D. Communicated by Professor Cayley, F.R.S. Received November 10, 1873.

(Abstract.)

Our present knowledge of what is called pure analysis has for its concrete basis the general theory of powers.

This science the author might, after Wronski, sanctioned by Lagrange, have called algorithmie, but he prefers giving it the designation *Calculus of Powers.*

The simple functions whose properties and relations it is the object of this latter calculus to determine are, first, the three direct functions or algorithms, z^n, a^z, $\sin z$; secondly, their three inverse functions or algorithms, $z^{\frac{1}{n}}$ (or $\sqrt[n]{z}$), $\log_a z$, $\sin^{-1}z$.

The author proposes to establish a new branch of analysis or algorithmie, which is based upon the general theory of factorials, and in which $z^{n/\mp\Delta z}$ replaces z^n.

The simple functions or algorithms whose properties and relations it is the province of this new calculus to determine are $z^{n/\mp\Delta z}$, $(1+h)^{\frac{z}{h}}$, $(1-h)^{\frac{z}{h}}$, $(1+h)^{-\frac{z}{h}}$, $(1-h)^{-\frac{z}{h}}$, $\underset{-h}{\sin} z$ $\underset{+h}{\sin} z$, and their inverse functions, $z^{\frac{1}{n}/\mp\Delta z}$ $\left(\text{or } \sqrt[n/\mp\frac{\Delta z}{n}]{z}\right)$, $\underset{\mp h}{\log} z$, a logarithm taken to the base $(1+h)^{\frac{1}{h}}$, or $(1-h)^{-\frac{1}{h}}$ and $\underset{-h}{\sin^{-1}} z$ $\underset{+h}{\sin^{-1}} z$.

The calculus so founded the author proposes to call the Calculus of Factorials.

The branches of the subject treated of in the present memoir will be understood from the following list of the contents of the various sections into which it is divided :—

Ch. I. § 1. Definition and properties of $z^{n/\mp\Delta z}$, or more generally $(a\pm z)^{n/\mp\Delta z}$, when n is a whole positive number.

§ 2. Factorials with a negative whole index.

§ 3. Factorials of which the index is a positive fraction.

§ 4. Factorials of which the index is a negative fraction.

§ 5. Factorial radicals.

Ch. II. § 1. Application of the theory of finite differences to factorials.

§ 2. Differenciation * of factorial exponentials and factorial logarithms.

§ 3. Development of the various simple functions into factorial series.

XVII. "On the Employment of a Planimeter to obtain Mean Values from the traces of continuously Self-recording Meteorological Instruments." By Robert H. Scott, M.A., F.R.S. Received May 23, 1874.

It is hardly necessary to remind the Fellows that the self-recording instruments employed by the Meteorological Committee at their Observatories for the continuous registration of pressure and temperature furnish their results in the form of photographic traces. The usual method of dealing with these barograms and thermograms, as they are respectively called, is to measure them at certain intervals by appropriate scales, and to treat the numerical values so obtained by arithmetical processes so as to arrive at mean results.

This method is naturally very laborious, and its accuracy is to some

* The author uses this word to denote that which in the calculus of finite differences takes the place of differentiation in the differential calculus.